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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/762,764	01/22/2004	Ming Xi	AMAT/4714.C1/CPI/WCVD/PJS	3117
44257	7590	10/17/2005	EXAMINER	
PATTERSON & SHERIDAN, LLP 3040 POST OAK BOULEVARD, SUITE 1500 HOUSTON, TX 77056			ZARNEKE, DAVID A	
			ART UNIT	PAPER NUMBER
			2891	
DATE MAILED: 10/17/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

EX

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/762,764	XI ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	David A. Zarneke	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 04 August 2005.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 16-20,23 and 26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 16-20,23 and 26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)             | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Response to Arguments***

In view of the appeal brief filed on 6/22/05, PROSECUTION IS HEREBY REOPENED. New grounds of rejection are set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

- (1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,
- (2) request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted (See 37 CFR 1.193(b)(2)).

Regarding the grounds of the appeal, three arguments were presented, the second and third being essentially the same, and they are addressed below.

The first argument is that Kang 700 fails to teach the bulk deposition of tungsten on the nucleation layer, and the examiner's reliance on the "possible" use of the W-CVD chamber as the metal line isn't a substitute for an "actual" W-CVD chamber used as the metal line.

The examiner notes that the use of the word "possible" in the advisory action was not intended to be speculation, it was merely in response to applicant's speculation as to the "possible" use of the W-CVD chamber (see page 2 of the remarks section of the

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response dated 5/2/05). It is the examiner's position, as clearly stated in all previous rejections that "while Kang fails to explicitly teach the tungsten is the bulk deposition layer filling the via, the examiner takes "official notice" since the claimed subject matter is notoriously well-known in the art (MPEP 2144.03), as evinced by applicant's own admitted prior art (APA) ([0005]-[0006]) and Chang et al., US Patent 5,028,565. The bulk deposition of tungsten of Kang is notoriously well known in the art. Tungsten is very commonly used to fill vias, as taught by the APA and Chang. Therefore, Kang's teaching (6, 13+) that a tungsten CVD chamber can be added to the cluster tool can be used for the bulk deposition of tungsten in to the via."

The second and third arguments are that Kang 965 doesn't teach the use of a boron-containing compound, especially diborane.

The examiner points out that this fact was acknowledged in the rejection of these claims. It is the examiner's position that the use of diborane as the B-compound of Kang 965 is obvious because it is a known B-compound used to supply boron. In order to further strengthen this contention, the examiner directs applicant to Takagi et al., US Patent 6,107,200 (abstract), and Authier et al. US Patent 4,113,532 (2, 29-39).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 16-18, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kang et al., U.S. Patent 6,139,700.

Kang teaches a method of forming a nucleation layer and a bulk deposition layer on a substrate having a via, said method comprising:

a) forming a refractory metal nucleation layer, WN, by serially exposing said substrate to first and second reactive gases (claim 16), wherein the refractory metal nucleation layer covers the via; and

b) forming a bulk deposition layer on said nucleation layer by employing vapor deposition to bulk deposit a refractory metal contained in one of said first and second reactive gases, wherein the bulk deposition layer fills the via (6, 13+), wherein the refractory metal is tungsten (2, 65+).

While Kang fails to explicitly teach the tungsten is the bulk deposition layer filling the via, the examiner takes "official notice" since the claimed subject matter is notoriously well-known in the art (MPEP 2144.03), as evinced by applicant's own admitted prior art (APA) ([0005]-[0006]) and Chang et al., US Patent 5,028,565. The bulk deposition of tungsten into the via of Kang is notoriously well known in the art. Tungsten is very commonly used to fill vias, as taught by the APA and Chang. Therefore, Kang's teaching (6, 13+) that a tungsten CVD chamber can be added to the cluster tool can be used for the bulk deposition of tungsten in to the via.

Further, Kang fails to teach the use of a plurality of vias.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a plurality of vias in the invention of Kang because the mere duplication of parts has no patentable significance unless a new and unexpected result is produced (In re Harza, 124 USPQ 378 (CCPA 1960)).

With respect to claim 17, Kang teaches the bulk deposition layer is deposited using chemical vapor deposition ((6, 13+).

As to claim 18, while Kang teaches the use of a separate chambers within a transfer chamber, It would have been obvious to one of ordinary skill in the art at the time of the invention to use a single chamber because the performance of two steps

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simultaneously, which have previously been performed in sequence was held to have been obvious [In re Tatincloux 108 USPQ 125 (CCPA 1955)].

In re claim 20, Kang teaches the use of  $WF_6$  (2, 65+).

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kang et al., U.S. Patent 6,139,700 (Kang 700), as applied to claim 19 above, and further in view of Kang et al., U.S. Patent 6,287,965 (Kang 965).

Kang 700 fails to teach the first reactive gas is diborane.

The Examiner points out that the comprising language of the present claims do not rule out the inclusion of a 3<sup>rd</sup> reactive gas to form a WBN layer.

Kang '965 teaches forming an ALD WBN layer followed by a W lower electrode layer (8, 1+). While not specifically stating that the B is supplied by diborane or any other B compound, the examples given relate to the formation of a TiAlN layer wherein all the components are supplied as compounds (8, 27+). One of ordinary skill in the art could then easily surmise that a B-compound would be used to supply the boron to the layer, especially in view of Takagi et al., US Patent 6,107,200 (abstract), and Authier et al. US Patent 4,113,532 (2, 29-39).

The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution. Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin 125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kang et al., U.S. Patent 6,139,700 (Kang 700), in view of Kang et al., U.S. Patent 6,287,965 (Kang 965).

Kang 700 teaches a method of forming a nucleation layer and a bulk deposition layer on a substrate disposed in a processing chamber, said method comprising:

forming a refractory metal nucleation layer by serially exposing said substrate to a first gaseous compound and a tungsten-containing compound (claim 8), wherein the serially exposing said substrate to a first gaseous compound and a tungsten-containing compound comprises:

exposing said substrate to the first gaseous compound for a period of time;

exposing said substrate to a pulse of the tungsten-containing compound;  
and

exposing said substrate to the first gaseous compound; and  
forming a bulk deposition layer on said nucleation layer by employing vapor deposition to bulk deposit a refractory metal contained in one of said first gaseous compound and tungsten-containing compound.

Regarding the use a boron-containing compound as the first gaseous compound, Kang 700 fails to teach the first reactive gas is a boron-containing compound.

The Examiner points out that the comprising language of the present claims do not rule out the inclusion of a 3<sup>rd</sup> reactive gas to form a WBN layer.



Kang '965 teaches forming an ALD WBN layer followed by a W lower electrode layer (8, 1+). While not specifically stating that the B is supplied by a B compound, the examples given relate to the formation of a TiAlN layer wherein all the components are supplied as compounds (8, 27+). One of ordinary skill in the art could then easily surmise that a B-compound would be used to supply the boron to the layer, especially in view of Takagi et al., US Patent 6,107,200 (abstract), and Authier et al. US Patent 4,113,532 (2, 29-39).

The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution. Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin 125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

While Kang fails to explicitly teach the tungsten is the bulk deposition layer filling the via, the examiner takes "official notice" since the claimed subject matter is notoriously well-known in the art (MPEP 2144.03), as evinced by applicant's own admitted prior art (APA) ([0005]-[0006]) and Chang et al., US Patent 5,028,565. The bulk deposition of tungsten of Kang is notoriously well known in the art. Tungsten is very commonly used to fill vias, as taught by the APA and Chang. Therefore, Kang's teaching (6, 13+) that a tungsten CVD chamber can be added to the cluster tool can be used for the bulk deposition of tungsten in to the via.

As to the period of time and the "pulse", which the examiner is assuming means the same as "a period of time" because there is nothing in the specification providing a

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definition or time limit for "pulse", Kang teaches exposing the substrate to the gases, and therefore it inherently is exposed for both a period of time and a pulse.

In re the second exposing the substrate to the first reactive gas step, Kang teaches repeating the steps of exposing the substrate to both the first and second reactive gas (2, 55+, step (g)). Since the present claims use comprising language the addition of a further step of exposing the substrate to the second reactive gas after the pulse of the first reactive gas is permissible (MPEP 2111.03).

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kang et al., U.S. Patent 6,139,700 (Kang 700), in view of Kang et al., U.S. Patent 6,287,965 (Kang 965).

Kang 700 teaches a method of forming a nucleation layer and a bulk deposition layer on a substrate disposed in a processing chamber, said method comprising:

forming a refractory metal nucleation layer by serially exposing said substrate to a first gaseous compound and a tungsten-containing compound (claim 8), wherein the serially exposing said substrate to a first gaseous compound and a tungsten-containing compound comprises:

exposing said substrate to a pulse of the first gaseous compound;

exposing said substrate to a pulse of the tungsten-containing compound;

and

exposing said substrate to the first gaseous compound for a period of

time; and

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forming a bulk deposition layer on said nucleation layer by employing vapor deposition to bulk deposit a refractory metal contained in one of said first gaseous compound and tungsten-containing compound.

Regarding the use a boron-containing compound as the first gaseous compound, Kang 700 fails to teach the first reactive gas is a boron-containing compound.

The Examiner points out that the comprising language of the present claims do not rule out the inclusion of a 3<sup>rd</sup> reactive gas to form a WBN layer.

Kang '965 teaches forming an ALD WBN layer followed by a W lower electrode layer (8, 1+). While not specifically stating that the B is supplied by a B compound, the examples given relate to the formation of a TiAlN layer wherein all the components are supplied as compounds (8, 27+). One of ordinary skill in the art could then easily surmise that a B-compound would be used to supply the boron to the layer, especially in view of Takagi et al., US Patent 6,107,200 (abstract), and Authier et al. US Patent 4,113,532 (2, 29-39).

The substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution. Ex parte Novak 16 USPQ 2d 2041 (BPAI 1989); In re Mostovych 144 USPQ 38 (CCPA 1964); In re Leshin 125 USPQ 416 (CCPA 1960); Graver Tank & Manufacturing Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

While Kang fails to explicitly teach the tungsten is the bulk deposition layer filling the via, the examiner takes "official notice" since the claimed subject matter is notoriously well-known in the art (MPEP 2144.03), as evinced by applicant's own

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admitted prior art (APA) ([0005]-[0006]) and Chang et al., US Patent 5,028,565. The bulk deposition of tungsten of Kang is notoriously well known in the art. Tungsten is very commonly used to fill vias, as taught by the APA and Chang. Therefore, Kang's teaching (6, 13+) that a tungsten CVD chamber can be added to the cluster tool can be used for the bulk deposition of tungsten in to the via.

As to the period of time and the "pulse", which the examiner is assuming means the same as "a period of time" because there is nothing in the specification providing a definition or time limit for "pulse", Kang teaches exposing the substrate to the gases, and therefore it inherently is exposed for both a period of time and a pulse.

In re the second exposing the substrate to the first reactive gas step, Kang teaches repeating the steps of exposing the substrate to both the first and second reactive gas (2, 55+, step (g)). Since the present claims use comprising language the addition of a further step of exposing the substrate to the second reactive gas after the pulse of the first reactive gas is permissible (MPEP 2111.03).

Co. V. Linde Air Products Co. 85 USPQ 328 (USSC 1950).

### ***Double Patenting***

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double

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patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 16-20, 23 and 26 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-4 of U.S.

Patent No. 6,620,723 in view of Wolf, Silicon Processing for the VLSI Era: Volume 2 – Process Integration, 1990, pp 192-194.

Although the conflicting claims are not identical, they are not patentably distinct from each other because the present claim are broader, in terms of the nucleation layer not being a boride layer specifically, and further add the bulk deposition layer. The forming of a bulk deposition layer is an obvious next step after forming a nucleation layer that would have been obvious to one of ordinary skill in the art.

Claims 16-20, 23 and 26 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-34 of U.S. Patent No. 6,831,004.

Although the conflicting claims are not identical, they are not patentably distinct from each other because the present claim are broader, in terms of the nucleation layer not being a boride layer specifically, and further add the bulk deposition layer. The forming of a bulk deposition layer is an obvious next step after forming a nucleation layer that would have been obvious to one of ordinary skill in the art.

Claims 16-20, 23 and 26 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-28

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of copending Application No. 10/993925. Although the conflicting claims are not identical, they are not patentably distinct from each other because the present claim are broader, in terms of the nucleation layer not being a boride layer specifically, and further add the bulk deposition layer. The forming of a bulk deposition layer is an obvious next step after forming a nucleation layer that would have been obvious to one of ordinary skill in the art.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

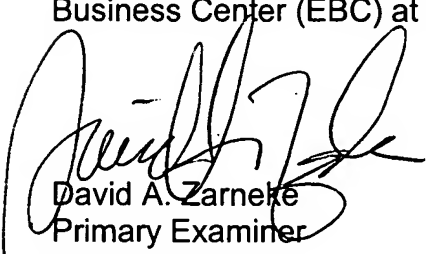
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to David A. Zarneke whose telephone number is (571)-272-1937. The examiner can normally be reached on M-F 7:30 AM-6 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William Baumeister can be reached on (571)-272-1712. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



David A. Zarneke  
Primary Examiner  
October 13, 2005